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| 10/820,343      | 04/07/2004  | Chien Ping Lee       | EICCP011X1          | 8156             |

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EXAMINER

MAGEE, THOMAS J

ART UNIT PAPER NUMBER

2811

DATE MAILED: 04/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/820,343

Applicant(s)

LEE ET AL.

Examiner

Thomas J. Magee

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cm

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 15 December 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Cancellations*

1. Applicant's cancellation of Claim 15 in Letter of 15 December 2004 is acknowledged.

### *Claim Rejections – 35 U.S.C. 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 5, 8, 11, and 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Streit et al. (US 5,631,477).

4. Regarding Claim 1, Streit et al. disclose a HBT comprising:

an emitter region (30a) (Figure 2) of one conductivity type (n) (Col. 4, lines 32 – 37),

a base region (40) of opposite conductivity type (p) (Col. 4, lines 49 – 50), abutting the emitter region,

a collector region (18a,20a,22a) of the one conductivity type (n) abutting the base region (40), the collector region comprising at least three layers having decreasing dopant concentrations toward the base region (Col. 4, lines 5 – 22), the (graded) layer in the collector

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region (22a) abutting the base region (40) having the lowest doping concentration ( $9 \times 10^{15}/\text{cm}^3$ ) and

a subcollector region (14a) of the one conductivity type (n) abutting the collector region, the collector region having a non-uniform doping with the lightest doping ( $9 \times 10^{15}/\text{cm}^3$ ) near the base region (40) and heaviest doping ( $1 \times 10^{19}/\text{cm}^3$ ) near the subcollector region (14a), the heaviest doping being less than the doping ( $2 \times 10^{19}/\text{cm}^3$ ) in the subcollector region.

5. Regarding Claims 5 and 11, Streit et al. disclose that the middle layer (20a) in the collector region has a concentration on the order of  $1 \times 10^{16}/\text{cm}^3$ , consistent with the recitations of the instant application.

6. Regarding Claim 8, Streit et al. disclose a HBT having improved safe-operating area characterized by a collector region (18a,20a,22a) between a base region (40) and a subcollector region (14a), the collector region having at least three layers (18a,20a,22a) of one conductivity type (n) and decreasing dopant concentrations toward the base region (Col. 4, lines 5 – 22), the layer (22a) in the collector region abutting the base region (40) having the lowest doping concentration ( $9 \times 10^{15}/\text{cm}^3$ ).

7. Regarding Claim 14, Streit et al. disclose that the one conductivity type of the three epitaxial layers (18a,20a,22a) of the collector region is N-type (Figure 2).

***Claim Rejections – 35 U.S.C. 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 2 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streit et al., as applied to Claims 1, 5, 8, 11, and 14, and further in view of Luryi (US 5,496,743).

10. Regarding Claims 2 and 9, Streit et al. do not disclose that the layer in the collector region abutting the base region is thicker than the other two or more layers in the collector region. Luryi discloses a composite ("solid material collection of more than two constituents") Col. 7, lines 26 – 28) wherein the layer (n+) abutting the base is thicker than the other layers (n++) (Col. 5, lines 7 – 9) (Col 5, lines 16 – 18). It would have been obvious to combine the layer structure of Luryi with Streit et al. to obtain a HBT with higher breakdown voltages (Luryi, Col. 7, lines 26 – 29).

11. Claims 3, 4, 6, 7, 10, 12, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streit et al., in view of Luryi, as applied to Claims 1 – 4, 5, 8, 9, 11, and 14.

12. Regarding Claims 3 and 10, Streit et al. disclose a layer in the collector region abutting the base region with a dopant concentration of the order of  $9 \times 10^{15}/\text{cm}^3$ , consistent with the recita-

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tion of the instant application. Streit et al. do not disclose that the layer in the collector region abutting the subcollector region has a dopant concentration on the order of  $2-4 \times 10^{16}/\text{cm}^3$ . Parameters such as dopant concentration in the semiconductor device manufacturing process are subject to routine experimentation and optimization to achieve device operational stability. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the doping of the layer abutting the subcollector, within the range as claimed, to form a stable device.

13. Regarding Claims 4 and 12, Streit et al. disclose a subcollector region with a dopant concentration of about  $2 \times 10^{19}/\text{cm}^3$ , consistent with the recited range of the order of  $5 \times 10^{18}/\text{cm}^3$ .

14. Regarding Claims 6 and 7, Streit et al. do not disclose that the layer in the collector region abutting the base region is on the order of 2 microns in thickness and that the thickness of the other two layers in the collector region are each on the order of 0.5 microns in thickness. Parameters such as thickness of constituent epitaxial layers are subject to routine experimentation and optimization to obtain high performance devices. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the thicknesses of the layers, as claimed, to obtain a quality device of high performance.

15. Regarding Claim 13, Streit et al. disclose that the one conductivity type of the three epitaxial layers (18a, 20a, 22a) of the collector region is N-type (Figure 2).

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### ***Response to Arguments***

16. Applicant's arguments with respect to claims have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusions***

17. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to **Thomas Magee**, whose telephone number is **(571) 272 1658**. The Examiner can normally be reached on Monday through Friday from 8:30AM to 5:00PM (EST). If attempts to reach the Examiner by telephone are unsuccessful, the examiner's supervisor, **Eddie Lee**, can be reached on **(571) 272-1732**. The fax number for the organization where this application or proceeding is assigned is **(703) 872-9306**.

Thomas Magee  
March 1, 2005

  
EDDIE LEE  
SPE TC2800